

IN THE CLAIMS:

1. (Presently Amended) A two-stage hybrid cryocooler comprising:
 - a first-stage Stirling expander comprising
 - a first-stage regenerator having a first-stage-regenerator inlet and a first-stage-regenerator outlet;
 - a second-stage pulse tube expander comprising
 - a second-stage regenerator having a second-stage regenerator inlet in gaseous communication with the first-stage-regenerator outlet, and a second-stage regenerator outlet,
 - a pulse tube having a pulse-tube inlet in gaseous communication with the second-stage regenerator outlet, and a pulse-tube outlet, wherein the second-stage regenerator and the pulse tube together provide a first gas-flow path between the first-stage regenerator and the pulse-tube outlet,
 - a pulse tube pressure drop structure having a pulse-tube-pressure-drop inlet in gaseous communication with the pulse-tube outlet, and a pulse-tube-pressure-drop outlet, and
 - a gas volume in gaseous communication with the pulse-tube pressure-drop outlet; and
 - a gas flow shunt providing gaseous communication between a the first-stage regenerator location at which a gas temperature is substantially the same as the gas temperature at the pulse-tube outlet and the pulse-tube outlet, wherein the gas flow shunt provides a second gas-flow path between the first-stage regenerator and the pulse-tube outlet.
2. (Canceled)
3. (Original) The hybrid cryocooler of claim 1, wherein the gas flow shunt provides gaseous communication between the first-stage regenerator outlet and the pulse-tube outlet.
4. (Original) The hybrid cryocooler of claim 1, wherein the pulse-tube outlet is maintained at the same temperature as the second-stage regenerator inlet.

5. (Canceled)

6. (Presently Amended) A two-stage hybrid cryocooler comprising:
a first-stage Stirling expander comprising
a first-stage regenerator having a first-stage-regenerator inlet and a first-
stage-regenerator outlet;
a second-stage pulse tube expander comprising
a second-stage regenerator having a second-stage regenerator inlet in
gaseous communication with the first-stage-regenerator outlet, and a second-stage
regenerator outlet,
a pulse tube having a pulse-tube inlet in gaseous communication with the
second-stage regenerator outlet, and a pulse-tube outlet, wherein the second-stage
regenerator and the pulse tube together provide a first gas-flow path between the first-
stage regenerator and the pulse-tube outlet,
a pulse tube pressure drop structure having a pulse-tube-pressure-drop inlet
in gaseous communication with the pulse-tube outlet, and a pulse-tube-pressure-drop
outlet, and
a gas volume in gaseous communication with the pulse-tube pressure-drop
outlet; and
a gas flow shunt providing ~~The hybrid cryocooler of claim 1, wherein the gas flow~~
~~shunt provides~~ gaseous communication between the first-stage regenerator inlet and the
pulse-tube outlet, wherein the gas flow shunt provides a second gas-flow path between
the first-stage regenerator and the pulse-tube outlet.

7. (Canceled)

8. (Original) The hybrid cryocooler of claim 1, wherein the pulse-tube outlet is maintained at an ambient temperature, and wherein the gas flow shunt provides gaseous communication between the first-stage regenerator inlet and the pulse-tube outlet.

9. (Original) The hybrid cryocooler of claim 1, wherein the second gas-flow path has a flow capacity of from about 5 to about 30 percent of the first gas-flow path.

10. (Original) The hybrid cryocooler of claim 1, wherein the gas flow shunt comprises
a flow-resistance control structure.
11. (Original) The hybrid cryocooler of claim 1, wherein the gas flow shunt comprises
a passive flow-resistance control structure.
12. (Original) The hybrid cryocooler of claim 1, wherein the gas flow shunt comprises
an active flow-resistance control structure.
13. (Previously Presented) A two-stage hybrid cryocooler comprising:
a first-stage Stirling expander comprising
a first-stage regenerator having a first-stage-regenerator inlet and a first-stage-regenerator outlet;
a second-stage pulse tube expander comprising
a second-stage regenerator having a second-stage regenerator inlet in gaseous communication with the first-stage-regenerator outlet, and a second-stage regenerator outlet,
a pulse tube having a pulse-tube inlet in gaseous communication with the second-stage regenerator outlet, and a pulse-tube outlet, wherein the second-stage regenerator and the pulse tube together provide a first gas-flow path between the first-stage regenerator and the pulse-tube outlet,
a pulse tube pressure drop structure having a pulse-tube-pressure-drop inlet in gaseous communication with the pulse-tube outlet, and a pulse-tube-pressure-drop outlet, and
a gas volume in gaseous communication with the pulse-tube pressure-drop outlet; and
a gas flow shunt providing gaseous communication between the first-stage regenerator and the pulse-tube outlet, wherein the gas flow shunt provides a second gas-flow path between the first-stage regenerator and the pulse-tube outlet, wherein the gas flow shunt comprises

a biased-flow-resistance control structure, wherein a pressure drop through the gas flow shunt is larger when a working gas flows therethrough toward the pulse-tube outlet than when the working gas flows therethrough away from the pulse-tube outlet.

14. (Canceled)

15. (Original) A two-stage hybrid cryocooler comprising:

a first-stage Stirling expander comprising

a first-stage regenerator having a first-stage-regenerator inlet and a first-stage-regenerator outlet, and wherein the first-stage regenerator inlet is maintained at an ambient temperature;

a second-stage pulse tube expander comprising

a second-stage regenerator having a second-stage regenerator inlet in gaseous communication with the first-stage-regenerator outlet, and a second-stage regenerator outlet,

a pulse tube having a pulse-tube inlet in gaseous communication with the second-stage regenerator outlet, and a pulse-tube outlet, wherein the second-stage regenerator and the pulse tube together provide a first gas-flow path between the first-stage regenerator and the pulse-tube outlet, and wherein the pulse-tube outlet is maintained at ambient temperature,

a pulse tube pressure drop structure having a pulse-tube-pressure-drop inlet in gaseous communication with the pulse-tube outlet, and a pulse-tube-pressure-drop outlet, and

a gas volume in gaseous communication with the pulse-tube pressure-drop outlet; and

a gas flow shunt providing gaseous communication between the first-stage regenerator inlet and the pulse-tube outlet, wherein the gas flow shunt provides a second gas-flow path between the first-stage regenerator and the pulse-tube outlet.

16. (Original) The hybrid cryocooler of claim 15, wherein the second gas-flow path has a flow capacity of from about 5 to about 30 percent of the first gas-flow path.